

## NRC Publications Archive Archives des publications du CNRC

### Small-scale fire test of 6 inch wall penetrated by telephone cables McGuire, J. H.

This publication could be one of several versions: author's original, accepted manuscript or the publisher's version. / La version de cette publication peut être l'une des suivantes : la version prépublication de l'auteur, la version acceptée du manuscrit ou la version de l'éditeur.

For the publisher's version, please access the DOI link below. / Pour consulter la version de l'éditeur, utilisez le lien DOI ci-dessous.

#### **Publisher's version / Version de l'éditeur:**

<https://doi.org/10.4224/40000594>

*Building Research Note, 1976-11*

#### **NRC Publications Archive Record / Notice des Archives des publications du CNRC :**

<https://nrc-publications.canada.ca/eng/view/object/?id=5a1b2f55-f977-4b4e-a834-3eb24ee6639e>

<https://publications-cnrc.canada.ca/fra/voir/objet/?id=5a1b2f55-f977-4b4e-a834-3eb24ee6639e>

Access and use of this website and the material on it are subject to the Terms and Conditions set forth at

<https://nrc-publications.canada.ca/eng/copyright>

READ THESE TERMS AND CONDITIONS CAREFULLY BEFORE USING THIS WEBSITE.

L'accès à ce site Web et l'utilisation de son contenu sont assujettis aux conditions présentées dans le site

<https://publications-cnrc.canada.ca/fra/droits>

LISEZ CES CONDITIONS ATTENTIVEMENT AVANT D'UTILISER CE SITE WEB.

**Questions?** Contact the NRC Publications Archive team at

PublicationsArchive-ArchivesPublications@nrc-cnrc.gc.ca. If you wish to email the authors directly, please see the first page of the publication for their contact information.

**Vous avez des questions?** Nous pouvons vous aider. Pour communiquer directement avec un auteur, consultez la première page de la revue dans laquelle son article a été publié afin de trouver ses coordonnées. Si vous n'arrivez pas à les repérer, communiquez avec nous à PublicationsArchive-ArchivesPublications@nrc-cnrc.gc.ca.

19772

Ser  
TH1  
B92  
no. 116  
c. 2  
BLDG

# BUILDING RESEARCH NOTE

SMALL-SCALE FIRE TEST OF 6 INCH WALL PENETRATED  
BY TELEPHONE CABLES

by

J. H. McGuire

ANALYZED

Division of Building Research  
National Research Council of Canada

Ottawa, November 1976

3348449

# SMALL-SCALE FIRE TEST OF 6 INCH WALL PENETRATED BY TELEPHONE CABLES

by

J.H. McGuire

A positive pressure fire test was carried out on two small-scale 6 in. thick, high-temperature concrete walls penetrated by 13 multi-core and 6 coaxial telephone cables. Alumina-silica-ceramic bulk fibre, capped at the exterior face with cementitious sealant, constituted the firestopping around the cables. The penetrations proved satisfactory except for those involving the two largest cables, which gave unacceptably high temperatures after approximately 2 hr of test. Sealing the ends of the cables could have further improved performance.

The test reported in this note was carried out at the request of Bell Canada to supplement information gained from a series of similar tests, conducted in 1974, sponsored jointly by DBR and Bell Canada. The object of the test was to determine whether penetrations by selected telephone cables would impair the fire containment integrity of a high-temperature concrete wall 6 in. thick, for a period of 2 hr. Failure criteria were as follows: temperatures exceeding 1000°F at the unexposed surfaces of the cables and development of openings greater than 0.1 sq in. (65 mm<sup>2</sup>).

## TEST SPECIMENS

The two walls, one installed at each end of the furnace consisted of high-temperature concrete, 16 in. square by 6 in. thick (406 mm x 152 mm), of density approximately 60 lb/cu ft (961 kg/m<sup>3</sup>). Figures 1 and 2 illustrate the specimen walls (after test), penetrated by the cables specified in Table 1. Firestopping was by alumina-silica-ceramic bulk fibre and one of three cementitious sealants. The cables were separated from each other by at least 3/4 in. (19 mm). The fibre packing was inserted from the exterior (unexposed) face of the wall and was allowed to protrude a little beyond the inside face. Packing was continued until the fibre wool extended to within an inch of the exterior face. The cementitious sealants listed in Table 2 were then used to cap the openings. There were no cables associated with openings F, H and J.

Small amounts of a pliable plastic sealant were applied at two locations on the exterior face of opening G and one on opening E (see Figures 1 and 2).

In previous tests the unexposed ends of the cables were capped to prevent the flow of hot gases through the cables when testing under positive pressure. As shown in Figures 1 and 2, this procedure was not followed during the current test.

## TEST PROCEDURE AND RESULTS

The furnace was operated for slightly over two hours, temperatures following the ULC S101 (ASTM E-119) time-temperature curve. Within 4 min of the start of the test, a positive pressure of 5 mm WG (Water Gauge) was established within the furnace; this was maintained (to within  $\pm 10\%$ ) for the duration of the test.

Temperatures were measured periodically with a 20 gauge Teflon insulated chromel-alumel thermocouple and are recorded in Figure 3. Adopting the failure criterion of 1000°F (537.8°C) at the unexposed surfaces of a cable, penetrations G5 and G7 failed at approximately 119 min and 122 min respectively. Based on the excessive opening criterion, G5 was the only penetration not meeting the requirement; failure occurred at 118 min.

Toward the end of the test, hot gases were seen to be issuing from the end of cable G5, between the wires and the metal sheath. Very high temperatures had developed resulting in the destruction of the insulation of most of the individual pairs. Subsequent examination of cables B and D, which were of a similar type, showed that they had exhibited the same behaviour to a lesser extent.

The exterior jackets of several of the metal shielded cables developed blisters beneath them. The first recorded was beneath D at 57 min and the blister punctured 2 min later. At 72 min, G5 developed a small blister that was dripping at 91 min. Over the same period, a blister had also developed beneath cable B. Rapid development of a blister beneath G4 was recorded at 84 min.

Some time after the test, the condition of the three capping materials was examined. The Flintkote "top 'n bond" appeared substantially unaffected by the exposure and, to a lesser extent, the same was true of the "Water Seal" quick-set cement. Although retaining reasonable strength, the vermiculite/sand/cement mixture had shrunk, however, and had left a crack at the perimeter of each penetration.

## CONCLUSIONS

The fire containment performance of 6 in. concrete wall specimens, including penetrations by various telephone cables ranging in diameter up to 3 in. (76 mm), remained satisfactory for almost 2 hr when exposed in a furnace operating at positive pressure. Firestopping involved alumina-silicate-ceramic bulk fibre and 1 in. cementitious capping. An experimental vermiculite/sand/cement capping was found to behave more poorly than two proprietary mixes.

## ACKNOWLEDGEMENTS

Acknowledgement is due to Messrs. R. G. Cotton and R. D. Parker of Bell Canada for the provision of the cables and for much of the planning of the test and to Messrs. P. Huot and R. Lamirande of DRB for ensuring the satisfactory execution of the test.

TABLE 1

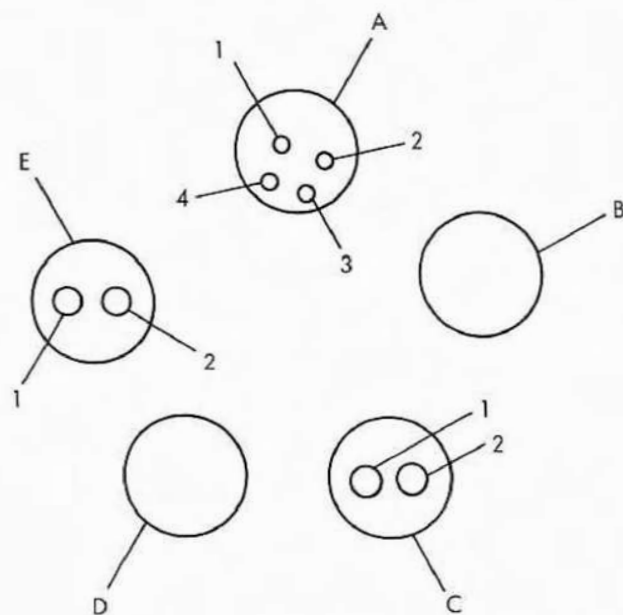
## TEST CABLES

Test Locations	Name	No. of Pairs and Gauge	OD	Shield	Jacket
C1, C2, E1, E2, G4, G7	Air core polyolefin insulated cable	50/19 AWG	1.12 in. (28.4 mm)	0.2 mm (0.008 in.) aluminum tape	Polyethylene
B	Paper-pulp insulated exchange cable	900/22 AWG	2.68 in. (68.1 mm)	0.2 mm (0.008 in.) aluminum tape	Polyethylene
D		3600/26 AWG	3.1 in. (78.7 mm)	and 0.15 mm (0.006 in.) steel tape, applied longitudinally, steel soldered	
G5		1800/26 AWG	2.38 in. (60.5 mm)		
G1, G6, G9	D Inside Wiring Cable	16/24 AWG	0.33 in. (8.4 mm)		PVC
G8		50/24 AWG	0.53 in. (13.5 mm)		
A1, A2, A3, A4, G2, G3	CATV Foam-dielectric coaxial cable		0.487 in. (12.4 mm)	(Outer conduct- or aluminum)	Polyethylene

TABLE 2

## CEMENTITIOUS CAPPING

Test Location	Capping
A, C, D, H	Flintkote "top 'n bond"
F	"Water Seal" quick set cement
B, E, G, J	Vermiculite, sand Portland cement (3:1:1)



CABLE NUMBERING KEY

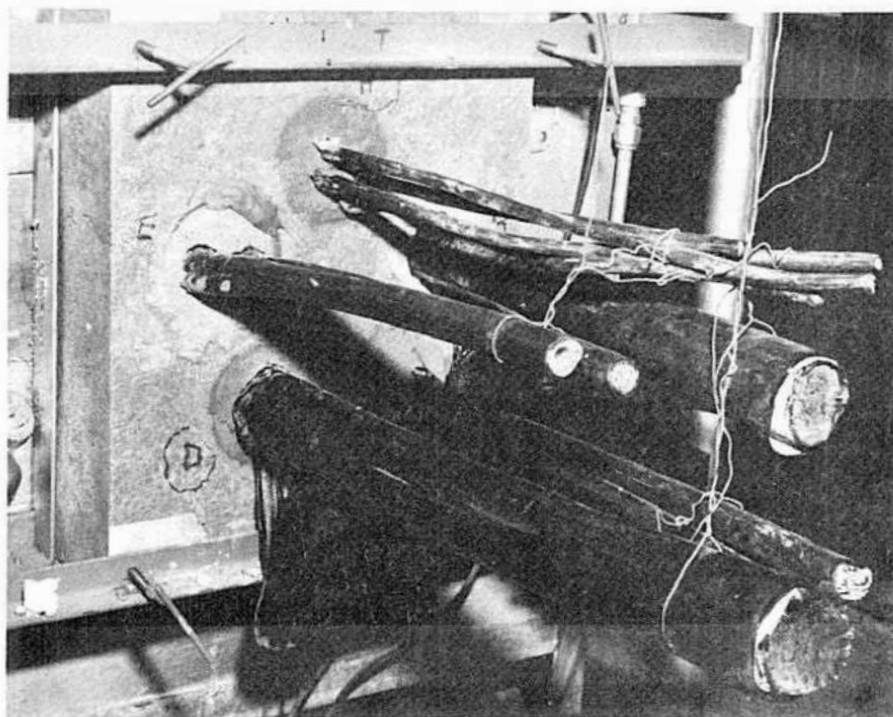
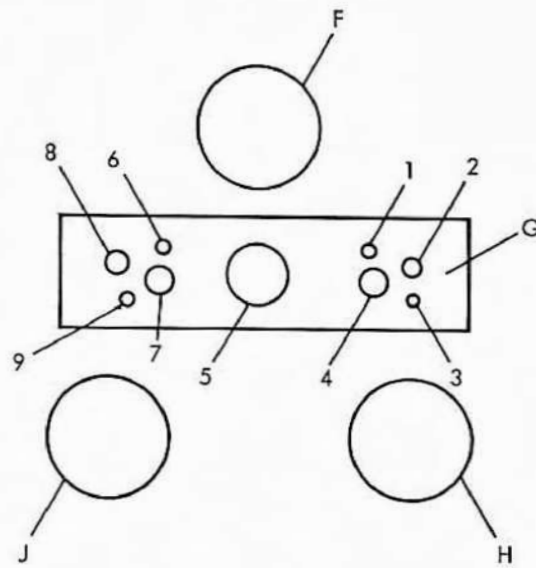


FIGURE 1  
UNEXPOSED FACE OF WALL SPECIMEN NO. 1  
AFTER TEST





CABLE NUMBERING KEY

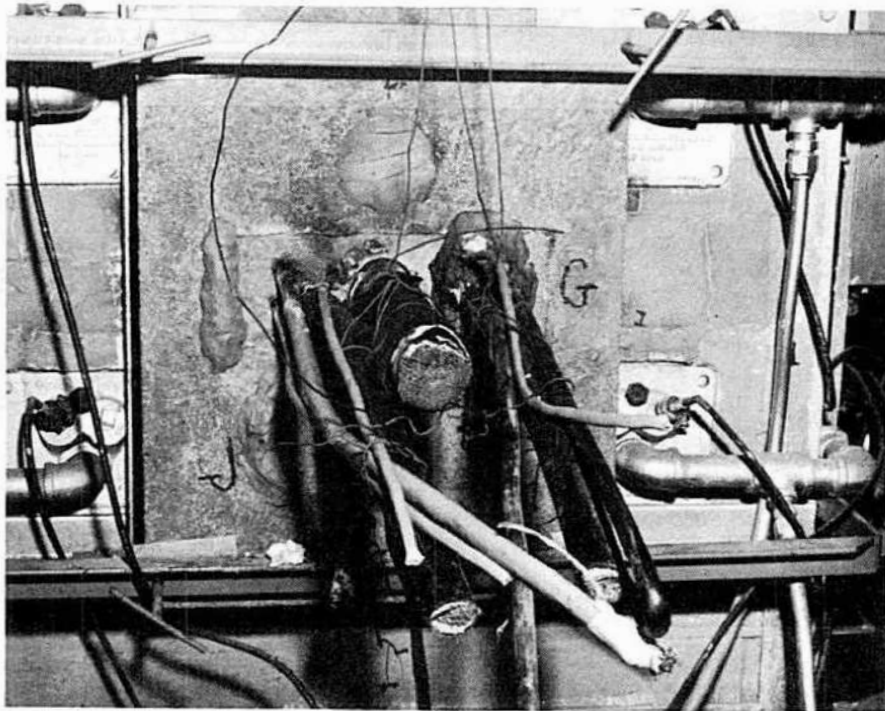


FIGURE 2  
UNEXPOSED FACE OF WALL SPECIMEN NO. 2  
AFTER TEST



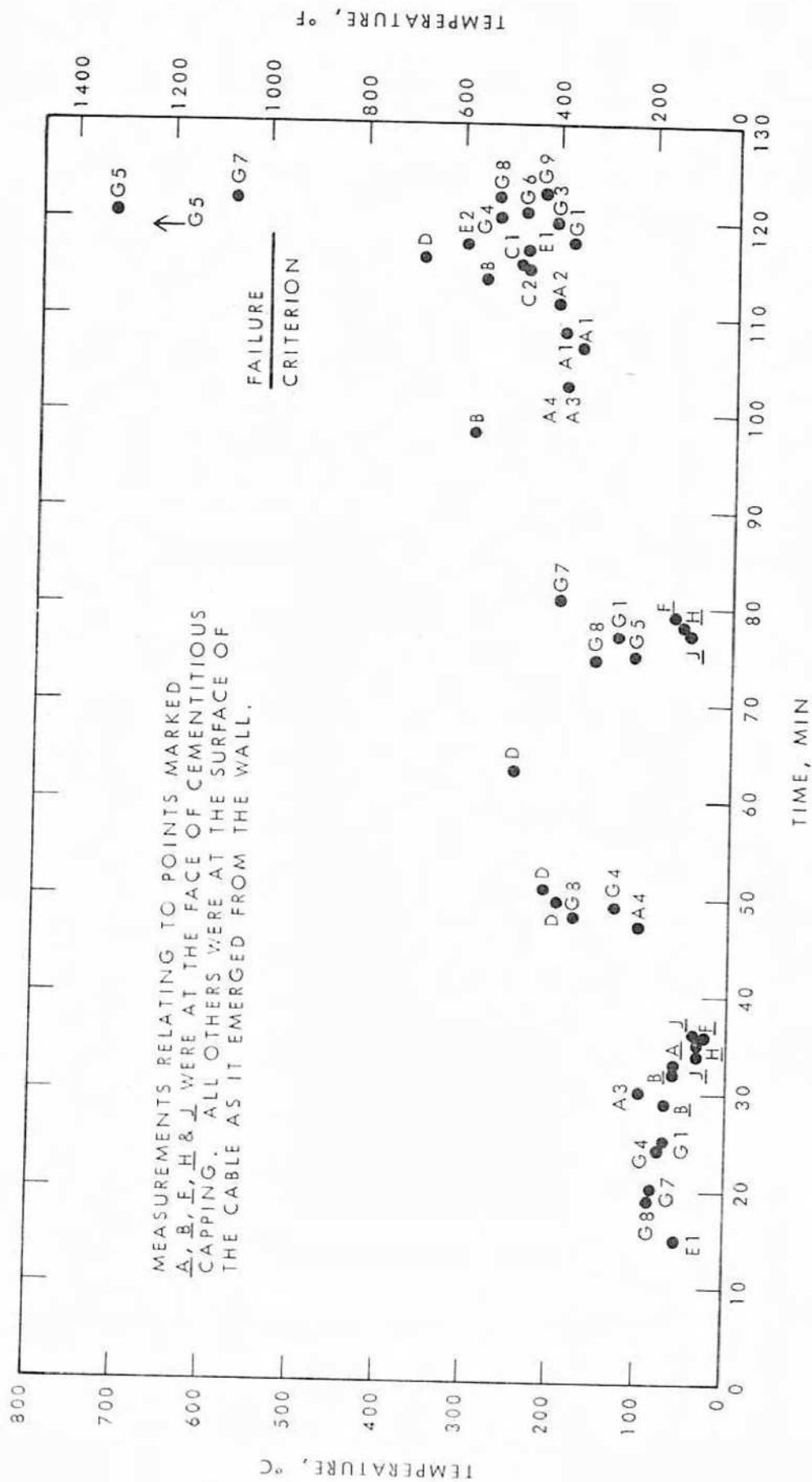


FIGURE 3  
TEMPERATURE MEASUREMENTS